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LLNL-PROC-644559

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October 4, 2013

Materials Research Society
San Francisco, CA, United States
April 21, 2014 through April 25, 2014

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LLNL-PROC-644559
2014 Spring Meeting of MRS, April 21-25, San Francisco, California

Studies of Passive Films on Friction Stir Processed Ni-Al Bronze

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Abstract

The Friction Stir Processing (FSP) and Friction Stir Welding (FSW) welding of nickel aluminum bronze (NAB) is used for a variety of naval applications. This paper investigates the beneficial effects of FSP on NAB passivity, and provides important benchmark data for future studies. Further enhancement of FSP NAB through application of LP will be discussed in subsequent papers, using the data presented here as a basis of comparison. This work shows that FSP has a beneficial effect on both the microstructure of this alloy, as well as on the integrity of the passive film formed in chloride electrolytes, including natural seawater. In addition to using a variety of characterization techniques to determine the effects of friction stir processing on microstructure, including scanning electron microscopy (SEM) with focused ion beam milling, we have used cyclic polarization (CP) and electrochemical impedance spectroscopy (EIS) to develop an understanding of passive film behavior for this material in the as-received state, as well as after friction stir processing. A variety of interfacial impedance models have been explored for fitting the data, including transmission line models. Results on this important alloy, before and after processing will be presented.

Key words: nickel aluminum bronze, NAB, friction stir processing, FSP, friction stir welding, FSW, cyclic polarization, CP, electrochemical impedance spectroscopy, EIS, scanning electron microscopy, SEM

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Auspices Statement

This work performed under the auspices of the U. S. Department of Energy (DOE) by LLNL under Contract DE-AC52-07NA27344.